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(54) **MEDIUM HAVING DATA STORAGE AND COMMUNICATION CAPABILITES AND METHOD FOR FORMING SAME**

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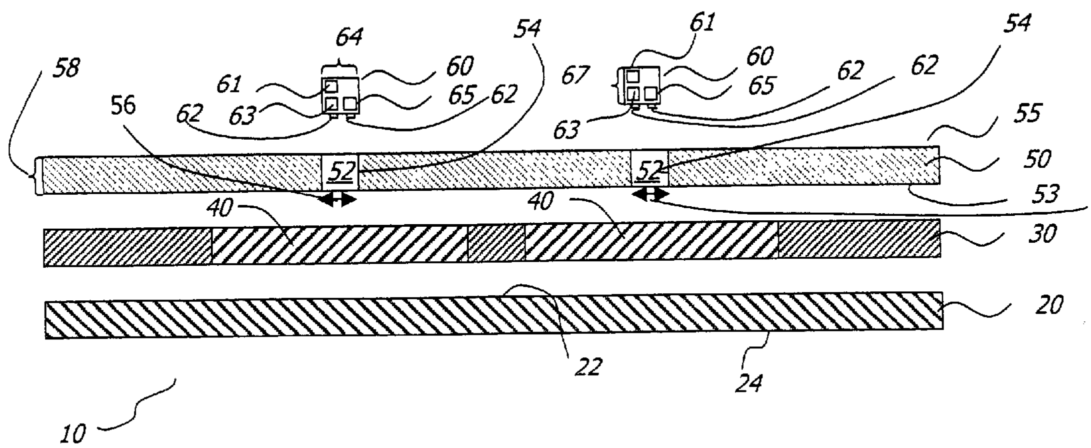
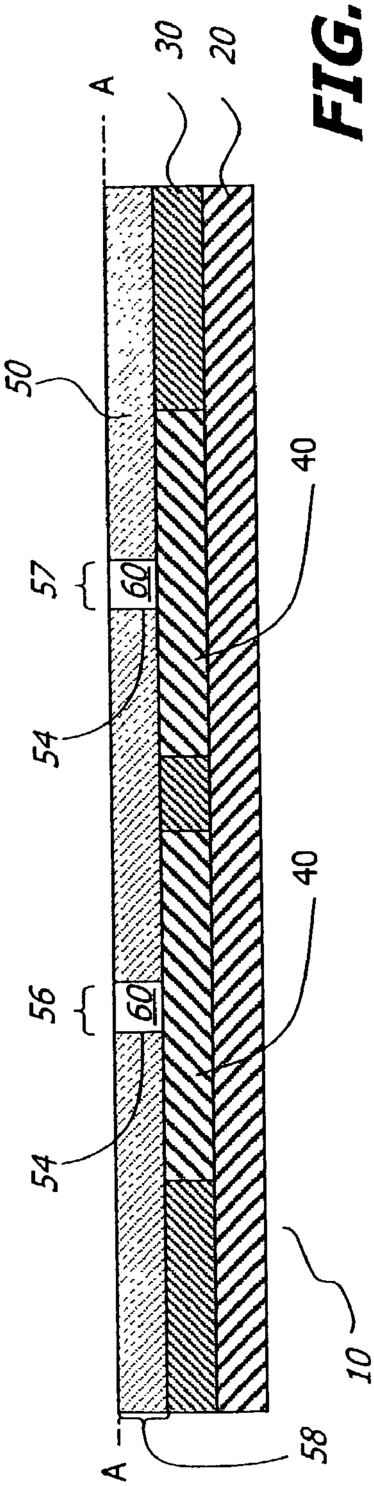
(57) **ABSTRACT**

A method for forming a medium is provided. A base layer is provided. A material layer is provided with the material layer having a void. A transponder having a memory is positioned in the void. A medium is also provided. The medium has a base layer and a material layer joined to the base layer. The material layer has a void. A transponder having a memory is positioned in the void.




A
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58
A

FIG. 1

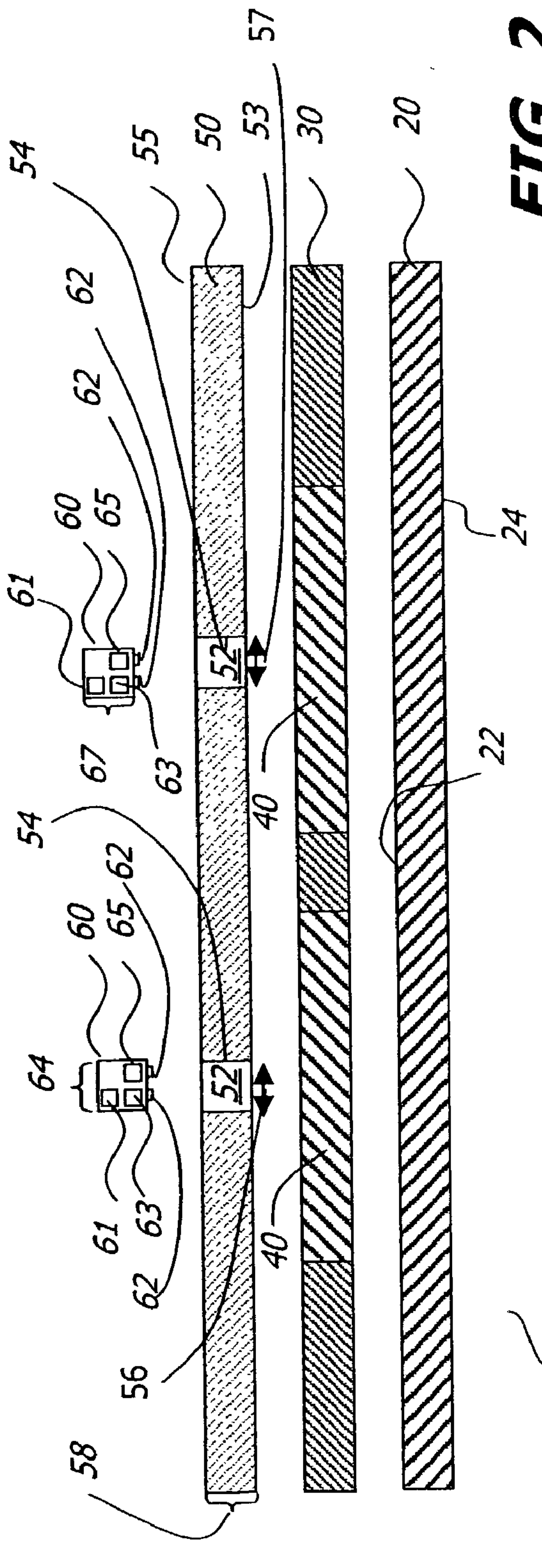
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FIG. 2

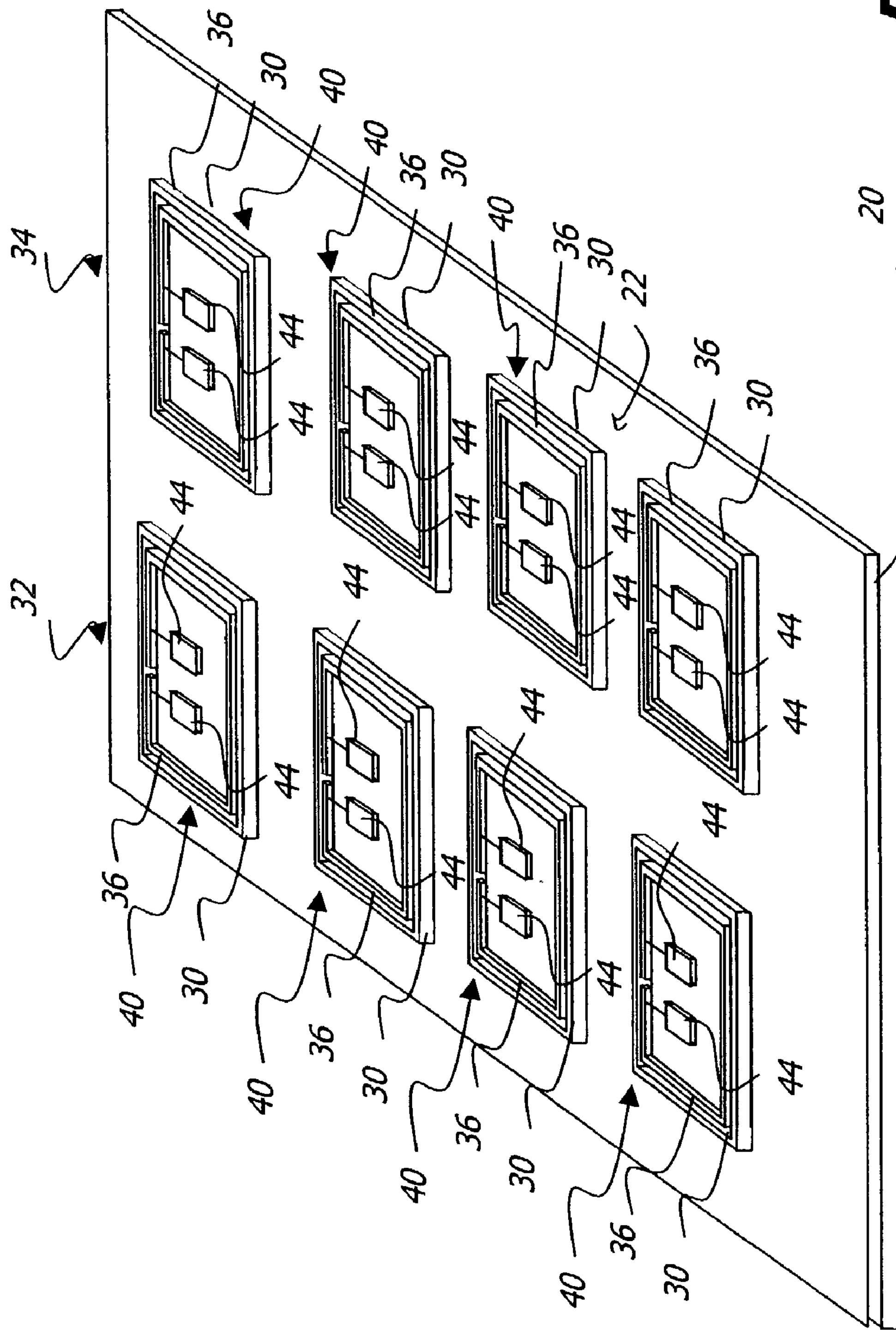


FIG. 3

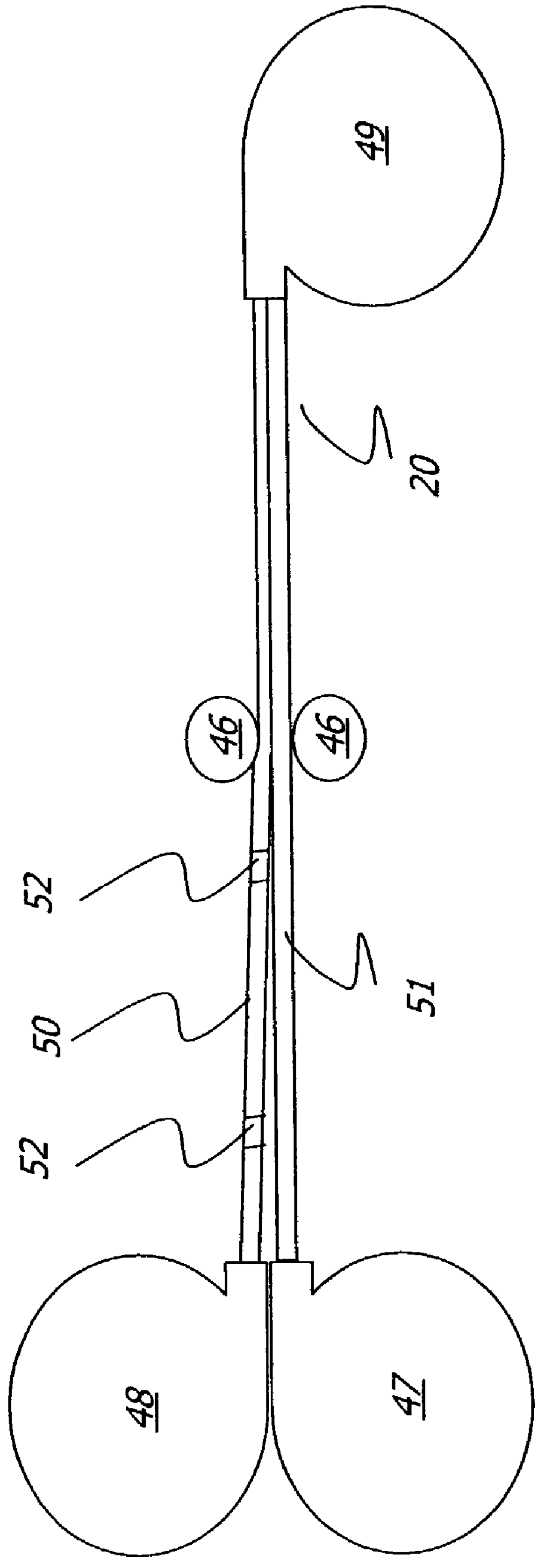
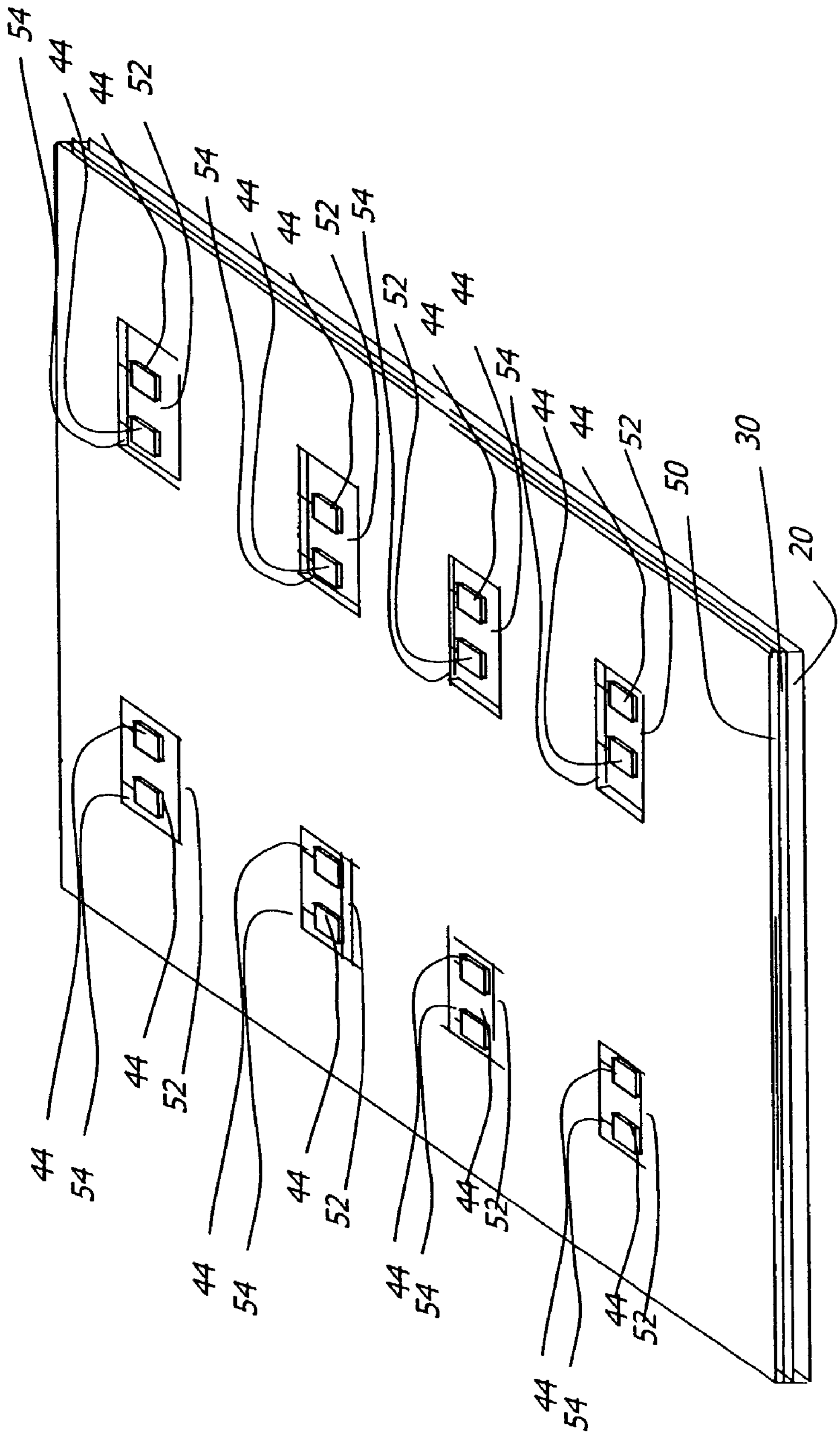


FIG. 4


54
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30
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FIG. 5

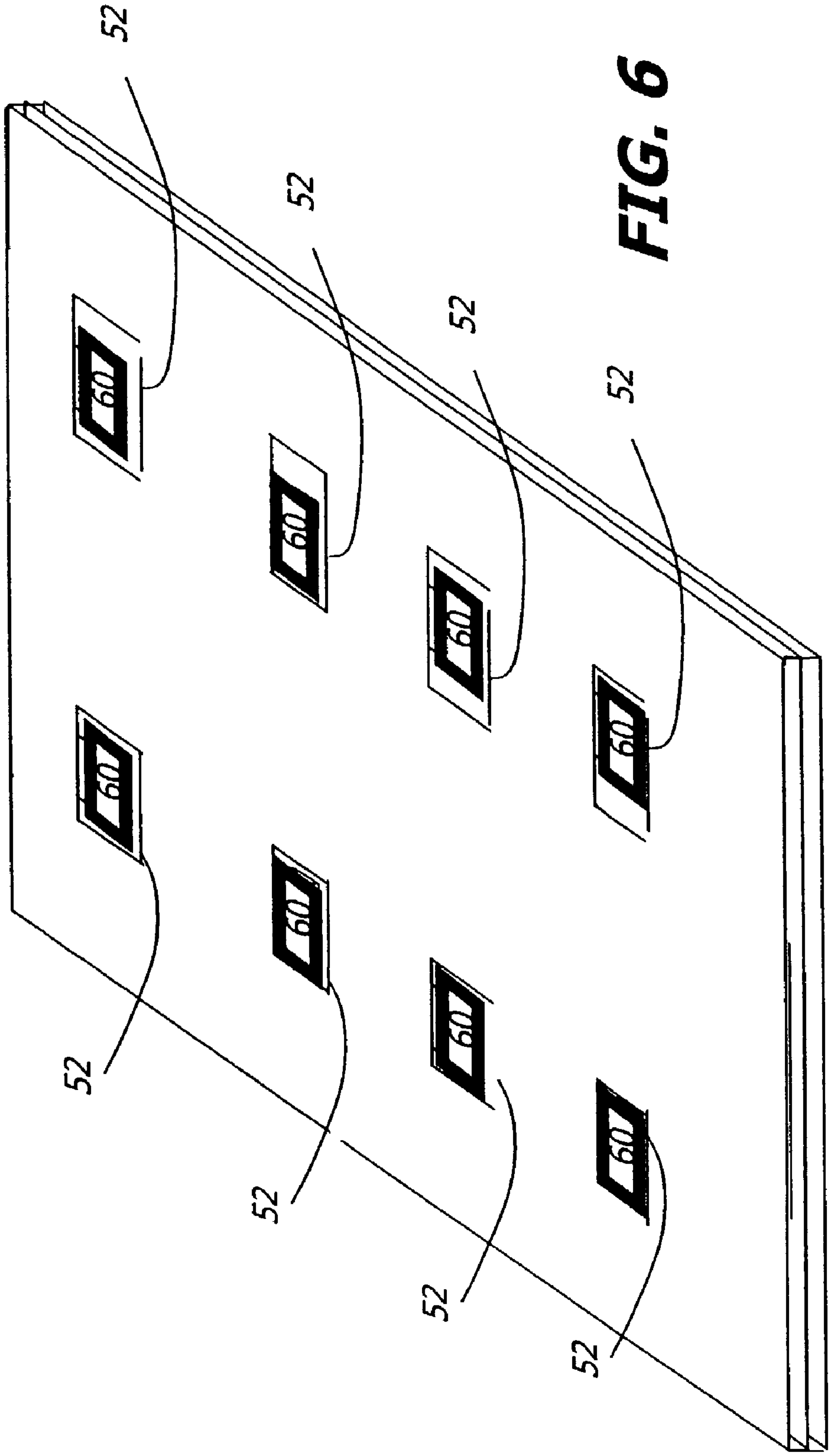


FIG. 6

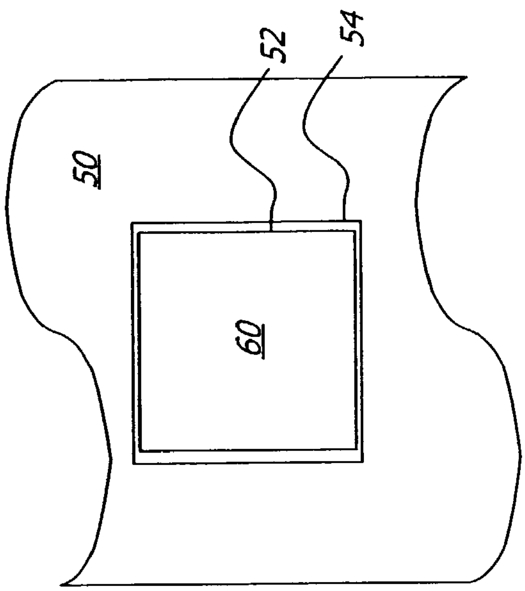


FIG. 8

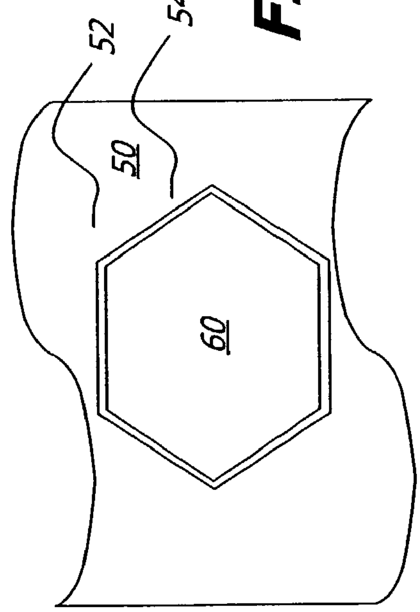


FIG. 9

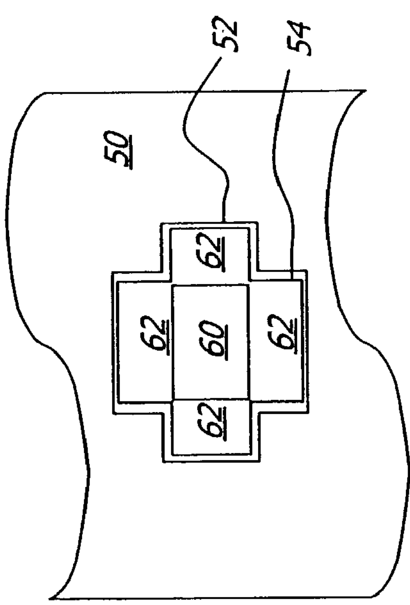


FIG. 7

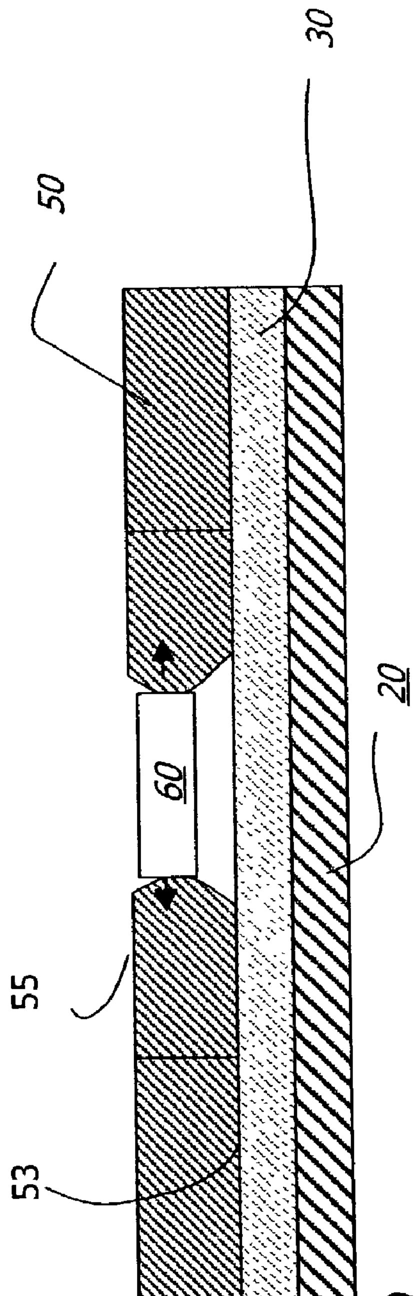


FIG. 10

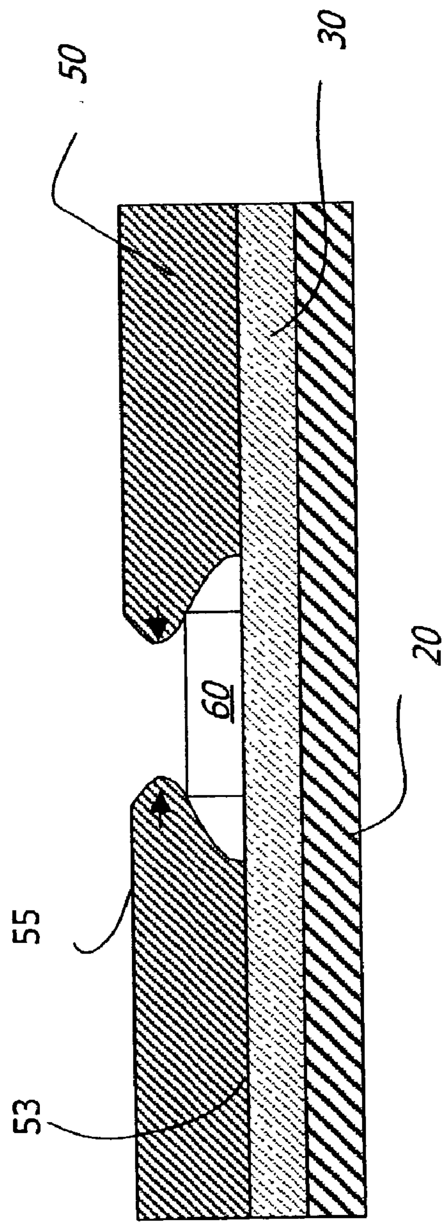
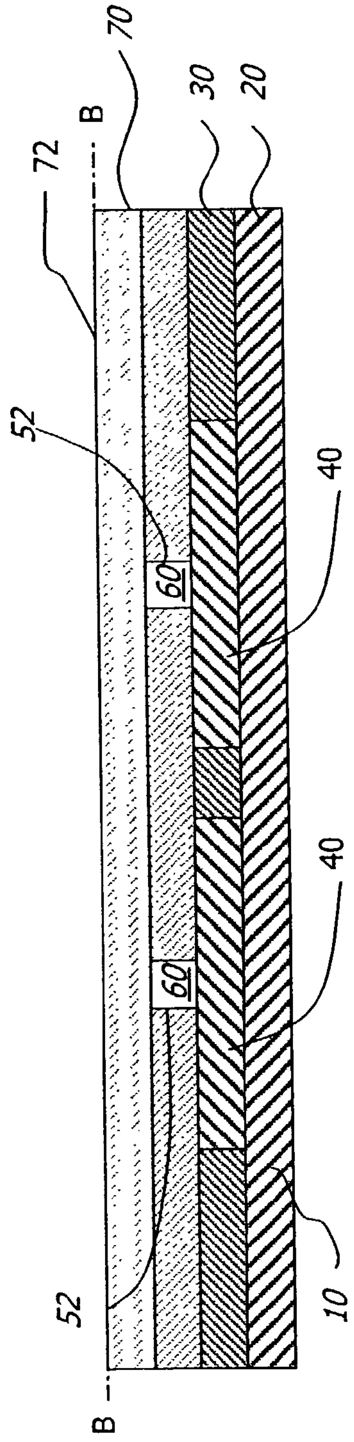


FIG. 11


B
72
70
30
20
52
60
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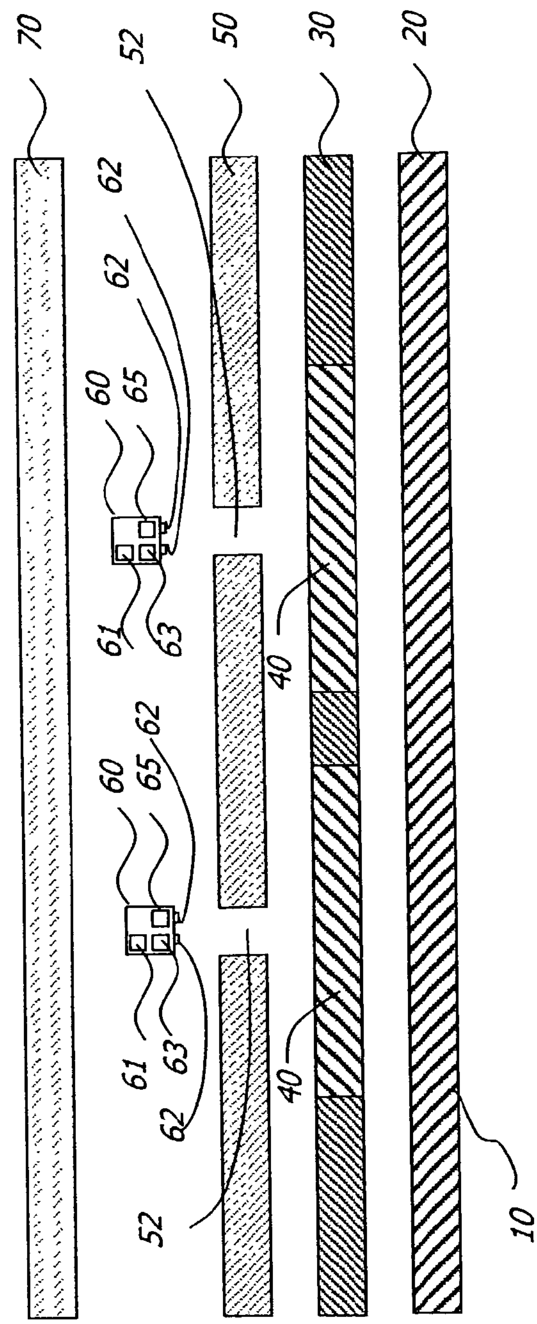
60
40
52
10
B

FIG. 12


70
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10

FIG. 13

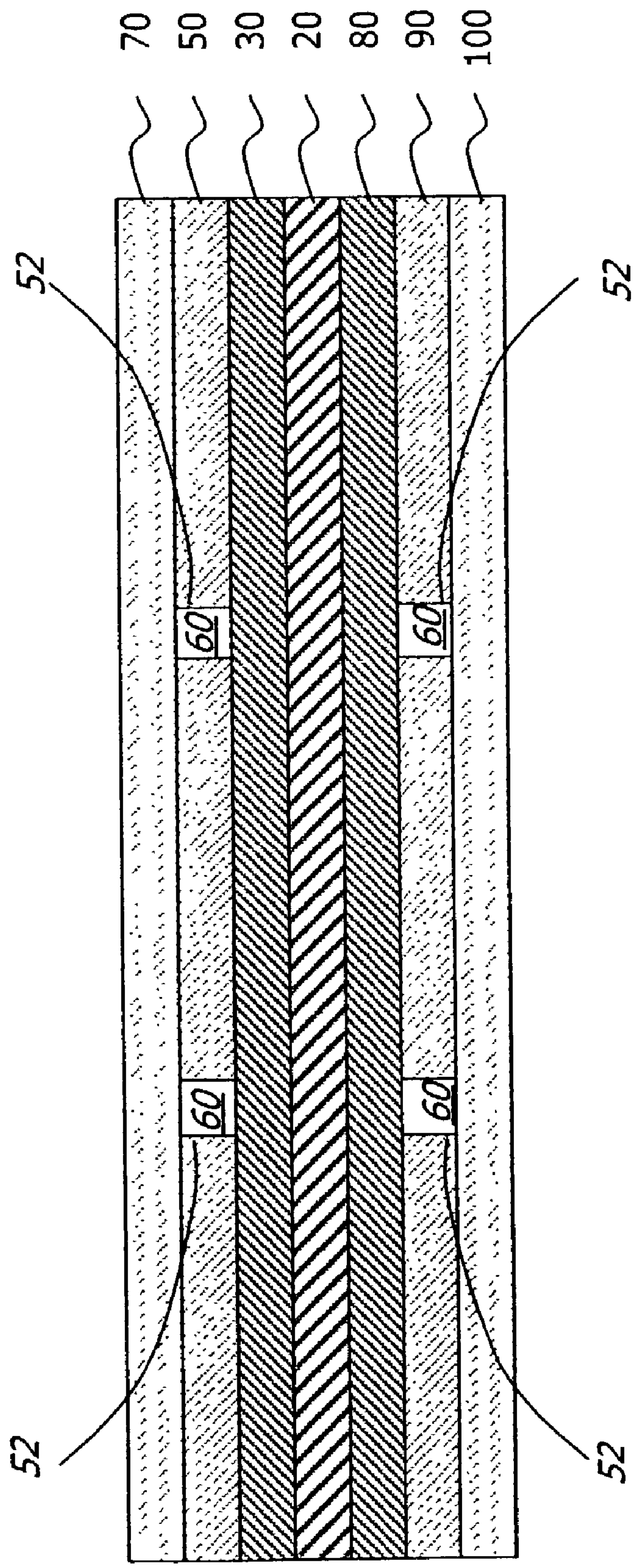

FIG. 14

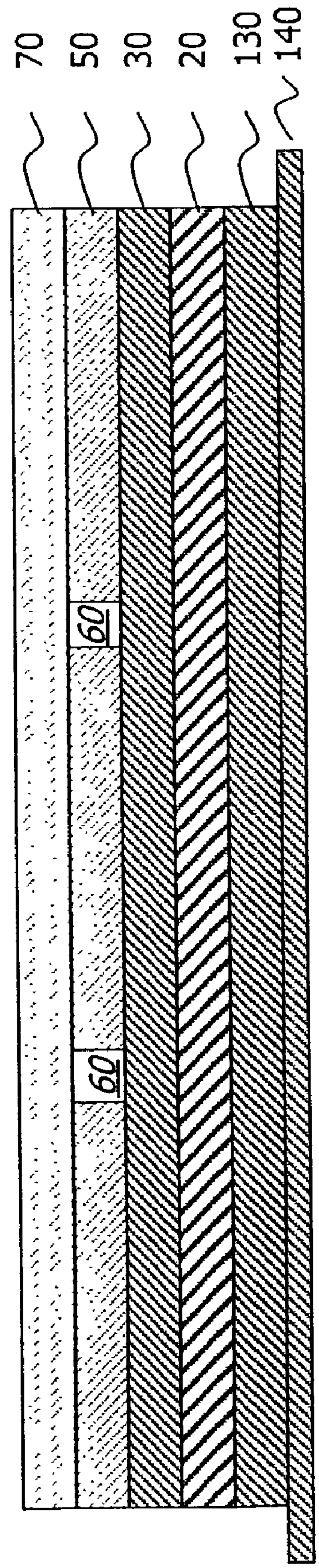

FIG. 15

MEDIUM HAVING DATA STORAGE AND COMMUNICATION CAPABILITES AND METHOD FOR FORMING SAME

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] Reference is made to commonly assigned copending U.S. patent application Ser. No. ______ (Docket 84691RRS) filed herewith, entitled MEDIUM HAVING DATA STORAGE AND COMMUNICATION CAPABILITIES AND METHOD FOR FORMING SAME, by Kerr et al. and U.S. patent application Ser. No. 10/161,514, entitled VIRTUAL ANNOTATION OF A RECORDING ON AN ARCHIVAL MEDIA by Kerr et al. filed on ______.

FIELD OF THE INVENTION

[0002] The present invention relates in general to the field of mediums and more particularly to mediums having electronic memory associated therewith.

BACKGROUND OF THE INVENTION

[0003] Thin mediums of material such as paper, film and fabric have many useful applications. Often images and information are recorded on such mediums. Where information regarding characteristics of the medium is known in advance of the recording process, the recording process can be adjusted to improve the quality of the recording. Once a recording has been made on a medium it can be useful to associate electronic information in a memory that is associated with the medium. Such electronic information can include information that describes the chain of custody of the medium, the use of the medium, and who has accessed the medium. Radio Frequency Identification (RFID) tags typically comprise three principal elements, an antenna and transponder that cooperate to send and receive electromagnetic fields containing information and a memory that stores information. Other useful information can also be associated with the medium such as electronic information that depicts information recorded on the medium. See for example, commonly assigned U.S. pat. appl. Ser. No. 10/161,514, entitled Virtual Annotation of a Recording on an Archival Media, filed by Kerr et al. on Jun. 3, 2002.

[0004] It is known to use Radio Frequency Identification (RFID) tags to provide the electronic memory and communication capabilities that allow electronic information to be associated with a medium.

[0005] The RFID tag is adapted to exchange information with a co-designed reading/writing device. Information that is stored in an RFID tag that is joined to an item can later be used to track, identify and process the item. The RFID tag can also store other information that is to be associated with the item. A commercially available "TAG-IT INLAY"™ RFID tag available from Texas Instruments, Incorporated, Dallas, Tex., USA, can be used to provide identifying information about an item to which it is attached. This relatively thin, flexible type of RFID tag can be used in applications that previously required a label or bar code. The RFID tags of the prior art are typically used for identification purposes, such as for employee badges, inventory control, and credit card account identification. The advantage of such RFID tags is that they are small in size, easy to communicate with and unlike a bar coded item, do not require the item to be aligned to the reader or scanner.

[0006] RFID tags have been proposed for use in applications with passports and credit cards, such as is disclosed in U.S. Pat. No. 5,528,222 filed by Moskowitz et al. These devices are useful for tracking the location, characteristics and usage of documents, books and packages. For example, such tags can be used to track the location of documents and track the chain of custody of such documents within a document management system.

[0007] RFID tags are typically formed into a package such as an inlay, a plastic glass or ceramic housing. The RFID package is then joined to an item such as a document or book after the item has been fully assembled. Typically the RFID tag has an adhesive surface that is used to form a bond between the RFID tag and the item to which it is being joined. It is also known to use other ways of mechanically joining an RFID tag to an item. For example, an RFID tag can be joined to an item using a staple or other mechanical fastener.

[0008] There is room for improvement in this arrangement. For example, a poor bond or poor mechanical joint between the RFID tag and the item can result in separation of the RFID tag from the item. This can defeat the purpose of joining the RFID tag to the item. Further, joining an RFID tag to an item increases the cost of the combined RFID tag and item because the RFID tag must include the cost of both the base and the fastener and the cost of labor associated with joining the RFID tag to the item. These costs can become significant where RFID tags are to be joined to a multiplicity of individual items, for example, individual sheets of medium such as film or paper.

[0009] Additionally, such RFID tags typically take the form of a patterned antenna located on a base having a transponder unit applied to the top of the antenna. Accordingly, such RFID tags have a non-uniform cross-sectional area. The non-uniform cross-section of the tag can make the tag vulnerable to incidental damage to contact during manufacturing, printing, use, storage and distribution. Further, such RFID tags can interfere with the appearance and the use of the item.

[0010] One approach for solving these problems is to incorporate RFID tags inside an item such as an identification badge. In one example, this is done by providing a clam shell type outer casing into which the RFID and antenna electronics are deposited. An example of such an identification badge is the ProxCard II proximity access card sold by HID Corporation, Irvine, Calif., USA. Thinner cards are made by sandwiching the RFID and antenna electronics between sheets of laminate material. An example of such a badge is the ISO ThinCard sold by HID Corporation, Irvine, Calif., USA. While this method of forming a card produces a card that is thinner than the clam shell type card, the card has an uneven cross-section with increased thickness in the area of the RFID electronics.

[0011] These techniques, however, are not feasibly applied to the task of forming a thin medium such as paper, film and fabric. Such thin mediums are typically fabricated in high volumes using coating, extrusion and rolling techniques to convert pulp, gelatin or other material into thin sheets of material that are then processed into useful forms. The addition of clam shell type structures known in the art is not practically or economically feasible in this type of production. The alternative lamination approach of the prior art is also not preferred because the increased thickness and uneven cross section caused by the presence of RFID electronics and antenna sandwiched between laminations, can interfere with subsequent fabrication processes causing damage to fabrication equipment and the RFID electronics and or to the medium itself. Further this uneven cross section can interfere with imaging equipment and medium when the laminated medium having an RFID unit is passed through equipment such as a printer that uses a medium after formation. This interference can damage the RFID tag, the medium and the equipment that uses the medium. The uneven cross section also creates a less than desirable appearance for the medium and images that are subsequently recorded thereon.

[**0012**] Thus a need exists for a medium that has the ability to store and electronically exchange data with the medium being compatible with conventional web fabrication processes and post fabrication uses of the medium.

SUMMARY OF THE INVENTION

[**0013**] In one aspect, the present invention comprises a method for forming a medium. A base layer is provided. A material layer is provided with the material layer having a void. A transponder having a memory is positioned in the void.

[**0014**] In another aspect what is provided is a method for forming a medium. An antenna layer is on a base layer. The antenna layer has an antenna formed therein. A transponder having a memory and adapted to cooperate with the antenna is provided. A material layer is joined to the antenna layer. The material layer has a thickness that is at least equal to the thickness of the transponder and has at least one void sized to receive the transponder is joined to the antenna layer. The transponder is positioned in the void to cooperate with the antenna.

[**0015**] In another aspect, a medium is provided. The medium has a base layer. A material layer is joined to the base layer with said material layer having a void. At least one transponder having a memory is in the void.

[**0016**] In another aspect what is provided is a medium having base layer. An antenna layer is on the base layer. The antenna layer has an antenna formed therein. A transponder having a memory and adapted to cooperate with the antenna is provided. A material layer is joined to the antenna layer. The material layer has a thickness that is at least equal to the thickness of the transponder and has at least one void sized to receive the transponder. The transponder is positioned in the void to cooperate with the antenna.

BRIEF DESCRIPTION OF THE DRAWINGS

[**0017**] A more complete understanding of the invention and its advantages will become apparent from the detailed description taken in conjunction with the accompanying drawings, wherein examples of the invention are shown, and identical reference numbers have been used, where possible, to designate identical elements that are common to the figures referenced below:

[**0018**] **FIG. 1** shows a cross section view of one embodiment of the medium of the present invention;

[**0019**] **FIG. 2** shows an exploded cross-section view of the embodiment of **FIG. 1**;

[**0020**] **FIG. 3** shows a top perspective view of a base layer having an antenna layer formed thereon;

[**0021**] **FIG. 4** illustrates one embodiment of the method for joining the material layer to a base layer having an antenna layer formed thereon;

[**0022**] **FIG. 5** shows a top perspective view of a base layer having an antenna layer and a material layer formed thereon;

[**0023**] **FIG. 6** shows the medium of **FIG. 5** with transponders formed thereon;

[**0024**] FIGS. **7-9** show various embodiments of mediums having voids with a transponder installed thereon;

[**0025**] FIGS. **10-11** show cross sectional views of a medium with voids having walls with shaped features to help receive and hold a transponder in a void;

[**0026**] **FIG. 12** is a cross section view of an embodiment having an overcoat layer.

[**0027**] **FIG. 13** is a cross-section and exploded view of the embodiment of **FIG. 12**;

[**0028**] **FIG. 14** is a cross-section view of an embodiment of the present invention having additional antenna, material and overcoat layers;

[**0029**] **FIG. 15** is a cross-section view of an embodiment of the present invention having an adhesive layer.

DETAILED DESCRIPTION OF THE INVENTION

[**0030**] The present invention will be directed in particular to elements forming part of, or in cooperation more directly with the apparatus in accordance with the present invention. It is to be understood that elements not specifically shown or described may take various forms well known to those skilled in the art.

[**0031**] An embodiment of the present invention will now be shown and described with reference to FIGS. **1-3**. **FIGS. 1 and 2** respectively show a cross-section view of one embodiment of the medium **10** of the present invention and an exploded cross-section view of the medium **10**. **FIG. 3** shows a top right perspective view of a base layer having an antenna layer formed thereon.

[**0032**] As is shown in **FIGS. 1 and 2** medium **10** has a base layer **20** having a top surface **22** and a bottom surface **24**. Base layer **20** can be formed from a material such as a paper, plastic, metal, fabric, or other convenient substrate. In certain embodiments, the material used in base layer **20** is selected to receive image forming materials such as inks, dyes, toners, and colorants. This permits images to be formed for example on bottom surface **24** using ink jet printing, thermal printing, contact press printing and other techniques. Alternatively, base layer **20** can also selected to form images when exposed to energy such thermal, electrical, optical, electromagnetic or other forms. In a further alternative a top or bottom surface of can be adapted by chemical or other treatments or coatings to receive images. In the embodiment shown, base layer **20** has a thickness of approximately 100 microns however, the thickness of base layer **20** is not critical.

[**0033**] In the embodiment that is shown in FIGS. **1-3**, an antenna layer **30** is formed on top surface **22** of base layer **20**. Antenna layer **30** comprises a material that is capable of being used to form an antenna. Examples of such materials include metals such as copper, aluminum and other materials having electrically conductive properties. Antenna layer **30** has patterned antennas **40** formed therein. **FIG. 3** shows a top view of a base layer **20** having patterned antennas **40** applied thereon. Antennas **40** are shown arranged in a first row of antennas **32** and a second row of antennas **34**. However other arrangements and distributions of antennas **40** can be used. Each one of antennas **40** has an antenna section **42** and mating surfaces **44**. As is shown in **FIG. 3**, rows of antennas **32** and **34** extend longitudinally along top surface **22** of base layer **20**. However, where medium **10** has two or more antennas **40**, such antennas can be arranged on antenna layer **30** in any useful pattern.

[**0034**] As is also shown in **FIG. 3** each of antennas **40** is formed from patterns of antenna layer **30** and spaces **46** in antenna layer **30**. The arrangement of spaces **46** that form the pattern of material comprising antennas **40** can be formed by applying antenna layer **30** to top surface **22** in a patterned fashion. This can be done for example by using printing, lamination, thermal transfer, or laser thermal transfer techniques to selectively transfer antenna layer **30** to top surface **22**. Alternatively, antenna layer **30** can be applied to top surface **22** to form a uniform layer, and portions of antenna layer **30** can be selectively removed to form spaces **36**. This selective removal can be done by etching or oblation processes that chemically, optically, thermally remove material from antenna layer **30** to form spaces **36** that define patterned antennas **40**. Mechanical processes can also be used to remove material from antenna layer **30** to form patterned antennas **40**.

[**0035**] A material layer **50** is provided. Material layer **50** can comprise a material including paper, film, polymer or other materials. In one embodiment, material layer **50** is formed from BUTVAR polyvinyl butgral (PVB) resin sold commercially by Solutial, St. Louis, Mo., USA. In the embodiment shown in **FIGS. 1 and 2** material layer **50** is formed from a material that receive image forming substances such as inks, dyes, pigments, colorants, used in the formation of images. In other embodiments, material layer **50** can be formed from a material that can be thermally, chemically or optically modified to form an image. In still other embodiments, material layer **50** can be chemically treated to adapt material layer **50** to receive images or to facilitate modification of the material layer **50** to permit formation of images thereon.

[**0036**] Material layer **50** is fabricated separately from base **20** and/or antenna layer **30**. During formation of the material layer **50**, voids **52** are formed in material layer **52**. These voids **52** are shown passing from a top surface **51** of material layer **50**, through the material layer to a bottom surface **53**. However, this is not necessary as voids **52** can comprise any form of void within material layer **52** that can receive a transponder **60** and/or an antenna.

[**0037**] **FIG. 4** shows one embodiment of a material layer **50** that is formed in rolls and applied to a web **51** having an antenna layer **30** thereon. Various techniques can be used to join material layer **50** to web **51**. For example material layer **50** can be joined to base layer **20** and/or antenna layer **30** using adhesives, pressure mounting or other techniques known in the art for joining a first layer of a material to a second layer. **FIG. 5** illustrates one example of this. As is shown in **FIG. 4**, web **51** of a base layer **20** having an antenna layer **30** is supplied by a web supply reel **47** and a material layer **50** having voids **52** is supplied by a material reel **48** by a pair of rollers **46** that press the material layer **50** onto web **51**. Either of web **51** or material layer **50** can be heated to facilitate bonding. This can be done for example by heating rollers **46**. The combined medium **20** is stored on a take up reel **49**.

[**0038**] **FIG. 5** shows a perspective view of a medium **20** formed by joining the material layer **50** to web **51**. In the embodiment shown in FIGS. **1-6**, transponders **60** have antenna engagement surfaces **62** defined to engage co-designed mating surfaces **44** formed on antenna layer **30** to provide an electrical connection. Using this electrical connection, power supply circuit **65** can receive electromagnetic signals that it converts into power that operates transponder **60**. This electrical connection can also be used to receive radio frequency signals having data. Transponders **60** each include a memory **61**. When transponder **60** is operated, radio frequency communication circuit **63** uses the electrical connection between mating surfaces **44** and antenna engagement surfaces **62** to transmit radio frequency signals that contain data from memory **61**. Radio frequency circuit **63** can also be used to receive radio frequency signals containing data and to store the data in memory **63**.

[**0039**] **FIG. 6** shows the medium **20** of **FIG. 5** with transponders **60** joined thereto. Transponders **60** are positioned in voids **52**. In the embodiment shown, voids **52** have openings at both of an inner surface **53** and an outer surface **55** of material layer **50**. In this embodiment transponders **60** can be inserted into voids **52** after formation of material layer **50**. Voids **52** are arranged so that insertion of transponders **60** into voids **52** brings antenna engagement surfaces **62** into contact with co-designed mating surfaces **44** formed on antenna layer **30** to provide an electrical connection between engagement surfaces **62** and mating surfaces **44**. In one embodiment, material layer **50** can be formed with transponders **60** inserted into voids **52** prior to joining material layer **50** to web **51**. In still another embodiment, transponders **60** can be joined to web **51** prior to joining material layer **50** to web **51**.

[**0040**] In the embodiment shown, voids **52** are sized to receive transponders **60** having a width dimension **56** and **57** that is at least equal to a width dimension **64** of transponders **60**. Alternatively, as will be described in greater detail below, where material layer **50** is formed from a material having a degree of elasticity, the width dimension **56** of voids **52** can be undersized with respect to a width dimension **64** of transponders **60**. Where voids **52** are undersized, insertion of transponders **60** into voids **52** causes deformation of material layer **50**. Material layer **50** resists this deformation and applies a force against transponders **60**. This force tends to hold transponders **60** within voids **52** and can be used to hold transponders **60** so that engagement surfaces **62** remain in contact with mating surfaces **44** of antennas **40** and do not slide along void **52** in a manner that would cause separation of engagement surfaces **60** from mating surfaces **44** Voids **52** have a void wall **54**. Void wall **54** can be shaped to align or otherwise position transponder **60** so that the antenna engagement surfaces **62** can engage mating surfaces **44** to provide an electrical connection between transponders **60** and an antenna such as antenna **32**. The shape of void wall **54** can be matched to a particular footprint of a particular transponder **60**. The shape of the void wall **54** can be a simple shape such as a square circle or a more complex form such as a cross, rectangle or other useful form, some examples of which are shown in **FIGS. 7, 8** and **9**.

[**0041**] **FIGS. 10 and 11** show cross sectional views of a void **52** having void walls **54** that are shaped with features to help receive and to hold transponder **60** in void **52**. As is shown, in **FIGS. 10 and 11** void walls **54** are narrower near outer surface **55** and wider near inner surface **53**. In this embodiment, material layer **50** is made from a material that permits some degree of elastic deformation. Accordingly, as shown in **FIG. 10** when a transponder **60** is pressed into the portion of void walls **54** that is near outer surface **55**, material layer **50** deforms to accept transponder **60** into the portion of void walls **54** that is near inner surface **55**. The portion of void walls **54** near to the top surface of material layer **52** then elastically expands as shown in **FIG. 11** to capture transponder **30** in material layer **52** in an area proximate to antenna layer **30**.

[**0042**] As is shown in **FIGS. 12 and 13**, in another embodiment, an overcoat layer **70** can be applied to material layer **50**. In this embodiment, overcoat layer **70** secures transponders **60** in perforations **52** respectively. Further, overcoat layer **70** seals and fills material layer **50** so that no portion of antenna layer **30** remains exposed after overcoat layer **70** has been applied. Overcoat layer **70** can be applied to fill portions of slots **52** and **54** that are not occupied by transponders **60**. This helps to secure transponder **60** and prevent movement of transponder **60** along slots **54** and **52**. Overcoat layer **70** can be adapted to receive image-forming materials. In the embodiment that is shown in **FIGS. 12 and 13**, overcoat layer **70** is applied to form a top surface B-B that does not have protrusions caused by transponders **60**. Alternatively, overcoat layer **70** can also be adapted to cushion and protect transponders **60** from thermal or mechanical damage during handling or manipulation of medium **20**.

[**0043**] Where an overcoat layer **70** is used, it is not essential that material layer **50** has a thickness that is at least as great as the thickness of transponders **60**. This is because a common plane e.g. B-B can be formed by a top surface **72** of overcoat layer **70** wherein overcoat layer **70** is applied to a thickness that, in combination with material layer **50** has a thickness that is at least as thick as the thickness of transponders **60**.

[**0044**] Where material layer **50** is adapted to receive image forming materials and such image forming materials can be applied to form images on material layer **50** before overcoat layer **70** is formed. In one such embodiment, overcoat layer **70** can comprise a transparent material that block the flow of ultraviolet or other forms of radiation or that provides protection against mechanical, thermal, chemical or other factors that may damage the appearance of the images formed on material layer **50**.

[**0045**] As is shown in **FIG. 14**, an additional antenna layer **80** can be formed on bottom surface **24** of base layer **20**. Additional antenna layer **80** can be formed in the manner described above with respect to forming antenna layer **30**. Similarly, an additional material layer **90** can be applied to additional antenna layer **80** with voids **92** formed therein. Voids **92** are adapted to receive transponders **60** and are otherwise similar to voids **52** as described above. As is also shown in **FIG. 14** an additional overcoat layer **110** can optionally be applied to additional material layer **90**.

[**0046**] In this embodiment, medium **10** is free of protrusions, thus medium **10** can be further processed as necessary using conventional web forming techniques such as winding, rolling, extruding and printing can be applied to medium **10** after transponder **60** has been positioned in the material layer of medium **10**. For example, a medium **10** having a transponders **60** attached thereto can be slit and wound onto rolls with each roll having at least one transponder **60**. Medium **10** can also be slit and chopped into sheet form with each sheet having a transponder **60** associated therewith.

[**0047**] As is shown in **FIG. 15**, an adhesive layer **110** can be applied to base layer **120** of medium **10** to permit medium **10** to be easily applied to a tangible thing such as a bottle. An advantage of such a medium is that a label can be provided that does not have a protrusion that might interfere with or be easily damaged by use and handling of the tangible thing to which the medium is attached. To facilitate handling of this adhesive embodiment of medium **10**, a removable layer **120** can be applied to adhesive layer **110**.

[**0048**] As described herein, any base layer **20**, antenna layer **30**, material layer **50**, and over coat layer **70** can comprise multiple layers.

[**0049**] Further, in any embodiment described transponder **60** can be formed in whole or in part by depositing circuit forming material on medium **20**. For example, transponder **30** can be formed on base layer **20**, antenna layer **30**, or in antenna layer **30** using lithographic, ink jet and other technologies that permit electronic circuits to be formed on a substrate. Transponder **60** can also be incorporated into voids **52** in material layer **50** before material layer **50** is joined to web **51**.

[**0050**] The invention has been described in detail with particular reference to certain preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

Parts List

[**0051**]

10	medium
20	base layer
22	top surface
24	bottom surface
30	antenna layer
32	row of antennas
34	row of antennas
36	spaces
40	antennas
42	antenna section
44	mating surface
46	roller
47	web supply reel
48	material supply reel

-continued

49	take up reel
50	material layer
51	web
52	void
53	inner surface
55	outer surface
56	width dimension
57	width dimension
59	top surface
60	transponders
62	engagement surface
63	memory
64	width dimension of transponder
65	radio frequency communication
66	Top surface of transponder
70	overcoat layer
80	additional antenna layer
90	additional material layer
92	voids
100	additional overcoat layer
110	adhesive layer
120	removable layer

What is claimed is:

1. A method for forming a medium comprising the steps of:

providing a base layer;

joining a material layer on the base layer with said material layer having a void; and,

positioning a transponder having a memory in the void.

2. The method of claim 1, further comprising the step of forming an antenna layer having an antenna on the base layer wherein the transponder is adapted to cooperate with the antenna when the transponder is positioned in the void.

3. The method of claim 1 wherein said transponder has a thickness and wherein the step of joining a material layer having a void comprises joining a material layer having a thickness that is at least equal to the thickness of the transponder.

4. The method of claim 1 wherein the material layer has a void with a width dimension that is smaller in size than a width dimension of the transponder and the step of positioning the transponder in the void comprises elastically deforming the material layer proximate to the void to receive the transponder.

5. The method of claim 1 further comprising the step of providing an overcoat layer on the material layer with the overcoat layer adapted to permit the formation of an image thereon.

6. The method of claim 1, further comprising the step of providing an overcoat layer on the material layer, void and transponder.

7. The method of claim 1, further comprising the step of providing an overcoat layer on the material layer, void and transponder to form a generally uniform outer surface.

8. The method of claim 1, wherein said material layer comprises material upon which an image can be formed.

9. The method of claim 2, wherein the step of forming the antenna layer comprises printing an antenna material onto the base in a pattern to form said antenna.

10. The method of claim 2, wherein the step of forming the antenna layer comprises the steps of providing a layer of antenna material and etching at least one antenna pattern in said antenna layer.

11. The method of claim 2, further comprising the step of providing an overcoat layer on the material layer, the transponder and the antenna layer said overcoat layer adapted to permit the formation of an image thereon.

12. The method of claim 2 further comprising the step of providing an overcoat layer on the material layer, transponder and antenna to form a generally uniform outer surface.

13. The method of claim 1 wherein the step of providing a base layer comprises providing a base layer having a bottom surface adapted to receive an image.

14. The method of claim 1 wherein the step of providing a base layer comprises providing a base layer having a bottom surface and applying a coating of material upon which an image can be formed.

15. The method of claim 1, further comprising the step of allying an overcoat layer adapted to provide protection against at least one of chemical, radiation, mechanical, electrical or optical damage.

16. The method of claim 1, further comprising the step of forming the medium into a roll having at least one roll transponder.

17. The method of claim 1, further comprising the steps of forming the medium into at least one sheet with each sheet having at least one transponder.

18. The method of claim 1, further comprising the step of recording data in the memory.

19. The method of claim 1 wherein the step of positioning a transponder in the void comprises forming a transponder in the void.

20. The method of claim 2 wherein the steps of positioning a transponder in the void comprises forming a transponder on the antenna layer in the void.

21. The method of claim 1 wherein the step of positioning a transponder in the void comprises positioning a transponder having an antenna in the void.

22. A method for forming a medium, the method comprising the steps of:

forming an antenna layer having an antenna on a base layer;

providing a transponder having a memory and adapted to cooperate with the antenna with the transponder having a thickness;

joining a material layer to the antenna layer, the material layer having a thickness that is at least equal to the thickness of the transponder and having a void sized to receive the transponder; and,

positioning the transponder in the void so that the transponder can cooperate with the antenna formed on the antenna.

23. The method of claim 22 wherein the transponder has a thickness within a predefined range and wherein the step of joining a material layer to the antenna comprises joining a material layer having a thickness that is at least equal to the thickness of the at least one transponder.

24. The method of claim 22 wherein the material layer has a width dimension that is smaller in size than a width dimension of the at least one transponder and the step of positioning the transponder in the void comprises elastically deforming the material layer proximate to the void to receive the transponder.

25. The method of claim 22 further comprising the step of providing an overcoat layer with the overcoat layer formed from a material upon which an image can be formed.

26. The method of claim 22, further comprising the step of providing an overcoat layer on each material layer, void and transponder.

27. The method of claim 22, further comprising the step of providing an overcoat layer on said material layer, void and transponder to form a generally planar outer surface.

28. The method of claim 22, wherein said material layer is formed from a material upon which an image can be formed.

29. The method of claim 22 wherein said material layer is adapted to permit the formation of an image thereon.

30. The method of claim 22 wherein the base layer has two sides and wherein the step of forming an antenna layer comprises forming an antenna layer having an antenna on each side.

31. The method of claim 30 wherein said antenna layers are printed onto both sides of the base layer by a thermal transfer printer.

32. The method of claim 30, wherein the step of forming said second antenna layer comprises the steps of providing a layer of antenna material on the opposite side of the base layer and etching at least one antenna pattern into each side.

33. The method of claim 30, wherein the step of joining a material layer to the antenna layer comprises joining a material layer to each antenna layer.

34. The method of claim 33, further comprising the step of providing an overcoat layer on each material layer, each overcoat layer adapted to permit the formation of an image thereon.

35. The method of claim 22, further comprising the step of forming the medium into rolls each having at least one transponder.

36. The method of claim 22, further comprising the step of recording data in the memory.

37. The method of claim 22 further comprising the step of forming the recording medium into at least one sheet with each sheet having at least one transponder.

38. A medium comprising:

a base layer;

a material layer joined to the base layer with said material layer having avoid; and, at least one transponder having a memory in the void.

39. The medium of claim 38 further comprising the step of providing an overcoat layer on the material layer said overcoat layer being formed from a material that permits the formation of an image thereon.

40. The medium of claim 38 further comprising an antenna layer having an antenna.

41. The medium of claim 40 wherein the antenna layer comprises a patterned antenna material.

42. The medium of claim 40, wherein the antenna layer comprises a layer of antenna material having an etched antenna pattern.

43. The medium of claim 38 further comprising an overcoat layer adapted to provide protection against at least one of chemical radiation, mechanical, electrical or thermal damage.

44. The medium of claim 38 further comprising an overcoat layer on the base layer opposite the antenna layer said overcoat layer adapted to permit the formation of an image thereon.

45. The medium of claim 38 further comprising an overcoat layer on the material layer said overcoat layer adapted to permit the formation of an image thereon.

46. The medium of claim 38 further comprising an adhesive layer.

47. The medium of claim 38 wherein said base layer is formed from a material that permits formation of an image thereon.

48. The medium of claim 38 wherein said transponder has a thickness within a predefined range and said material layer has a thickness at least equal to the thickness of said transponder.

49. The medium of claim 38 wherein said transponder has a width dimension said material layer comprises an elastically deformable material and said void has a width dimension smaller than the width dimension of said transponder.

50. The medium of claim 38 further comprising an overcoat layer adapted to provide protection against at least one of chemical, radiation, mechanical, electrical or thermal damage.

51. The medium of claim 45 wherein the base layer has a bottom surface coated with a material upon which an image can be formed.

52. A medium comprising:

an antenna on a side of a base layer,

a transponder with having a memory and an interface patterned to cooperate with at least one antenna the transponder having a thickness; and

a material layer joined to the antenna layer, the material layer having a void sized to receive said transponder;

wherein said transponder is positioned in the void to cooperate with the antenna.

53. The medium of claim 52 further comprising an overcoat layer on the material layer said overcoat layer being formed from a material that permits an image to be formed thereon.

54. The medium of claim 52 wherein said material layer formed from a material that permits the formation of an image thereon.

55. The medium of claim 52 wherein the base layer is formed from a material that permits an image to be formed thereon.

56. The medium of claim 52 wherein said antenna layer is printed onto the base.

57. The medium of claim 52 wherein said overcoat layer is adapted to protect the medium from at least one of thermal, radiation, chemical, mechanical or damage.

58. The medium of claim 52 further comprising a second material layer having a second void joined to a second side of the base and a second transponder located in the second void.

59. The medium of claim 58 further comprising a second antenna layer between the second material layer and the base said second material layer comprising an antenna.

60. The medium of claim 52 wherein said transponder is formed on the medium.

61. The medium of claim 52 wherein said transponder is formed in the void.

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